





# Roundup Ready® Alfalfa Update

## *24<sup>th</sup> Kentucky Alfalfa Conference*

### *February 26<sup>th</sup>, 2004*

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ROUNDUP READY ALFALFA IS NOT APPROVED FOR SALE OR DISTRIBUTION IN THE U.S. ROUNDUP ©BRAND HERBICIDES ARE NOT REGISTERED FOR THIS USE. IT IS A VIOLATION OF FEDERAL LAW TO PROMOTE ANY UNREGISTERED HERBICIDE USE.  
Always read and follow herbicide label directions.

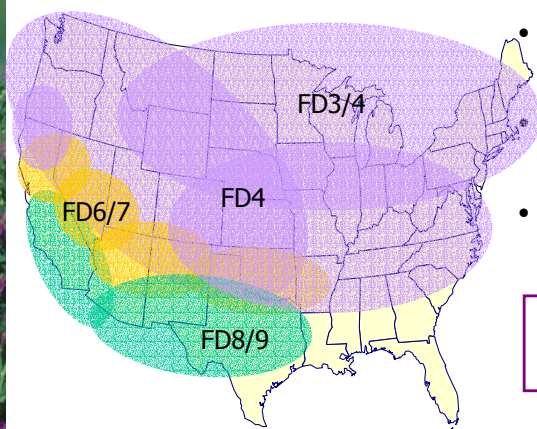


# Introduction- Project Background

- Monsanto and Forage Genetics International are working together in a business partnership to develop Roundup Ready® alfalfa.
  - Monsanto is a leader in Roundup Ready trait technology.
  - Forage Genetics International is a leader in the development of elite alfalfa genetics.
- We will broadly license this technology to other seed companies so that it will be available in the brands that growers trust.
- We're excited about the potential this product holds for alfalfa growers and will share the value with those who choose to purchase it.



## Introduction- Variety Availability



- Winter hardy FD3/4
- Semi-dormant FD6/7
- Non-dormant FD8/9

*RR Cultivars for All Major Markets*



## Introduction- Weeds in Alfalfa



- Weeds in alfalfa production can:
  - Compete with alfalfa seedlings during establishment (In some cases cause stand failure),
  - Significantly reduce yields,
  - Lower forage quality,
  - Increase susceptibility to disease and insects,
  - Reduce stand life,
  - Can be toxic to livestock,
  - Decrease grower profitability.



## Introduction- Weed Control Challenges



- Weed control in alfalfa can be challenging.
  - At seeding, when weed control is critical, weeds can germinate faster and out-compete alfalfa seedlings.
  - Currently available control products have limitations including:
    - Requirements for soil incorporation,
    - Narrow window of application,
    - Narrow weed control spectrum,
    - Relatively long pre-harvest intervals,
    - Risk of crop injury,
    - Crop rotation restrictions.
  - Cover crops have advantages and disadvantages



## Introduction- Roundup Ready Alfalfa



- Roundup Ready alfalfa, like other Roundup Ready crops, has been developed to tolerate over-the-top applications of Roundup<sup>®</sup> brand agricultural herbicides.
- The result is an effective and flexible weed control tool for alfalfa growers.



## Potential Benefits of Roundup Ready Alfalfa



Roundup Ready alfalfa will offer growers a simple, dependable tool for control of broadleaf and grassy weeds for the life of the alfalfa stand

- Effective weed control in the seedling year is important to stand establishment. The Roundup Ready system can provide weed control without risk of crop stunting or injury when establishing alfalfa.
- Fewer weeds lead to less foreign matter in forage and better quality animal feed. The Roundup Ready system can help meet demands for cleaner, more dependable forage.
- The family of Roundup agricultural herbicides has an excellent 25-year history of safe use. The Roundup Ready system replaces the need for pre-plant incorporated treatments and post-emergence treatments of commonly used herbicides having less favorable environmental characteristics.



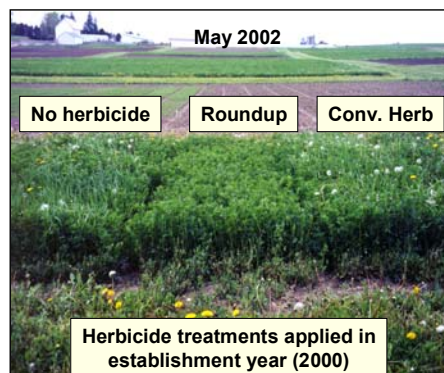
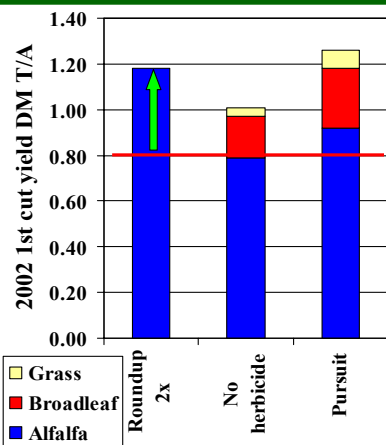
## Management Considerations



- Weed control during stand establishment
  - Weed control before and after seeding is critical for establishing a healthy stand.
  - Test results conducted by Monsanto and Forage Genetics indicate:
    - Roundup applications prior to seeding and shortly after seedling emergence result in excellent stands nearly free of weeds.
    - Excellent crop safety with respect to forage yield and quality.
- Weed control in mature stands may be important to maintaining forage quality.



## 2000 UW Herbicide Study

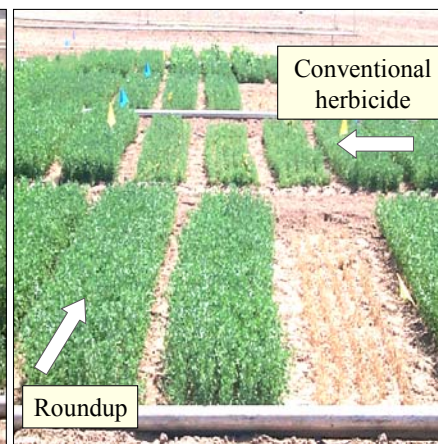
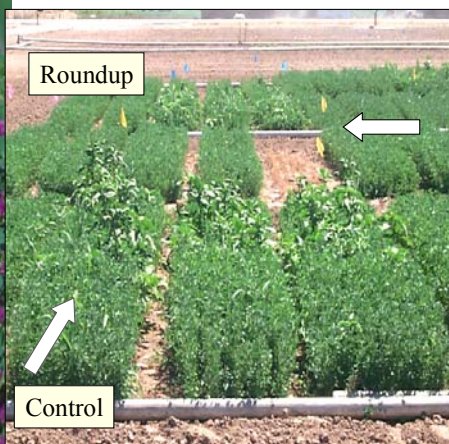


## Demo Plot – Idaho June 2000



Excellent weed control, no yield lag

Excellent crop safety





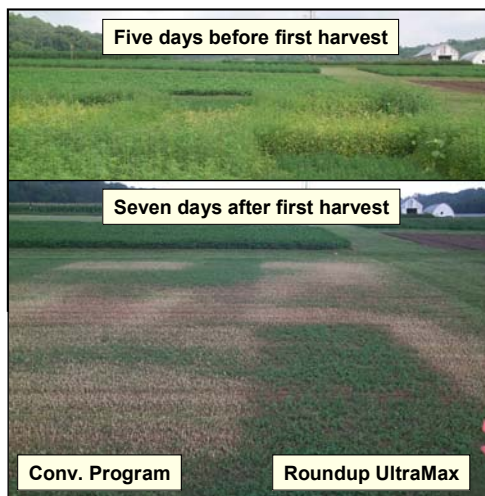


## 2001 Wisconsin Seeding Study

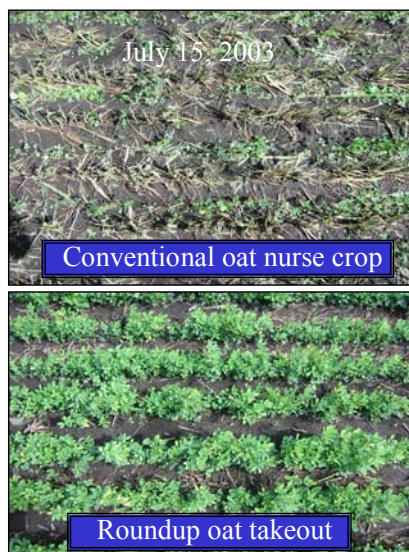


Product concept testing to evaluate efficacy and crop safety

- Plot area infected with weed seed.
- RR alfalfa seed used to establish plots
- Various herbicide treatments applied
- Only Roundup gave effective weed control

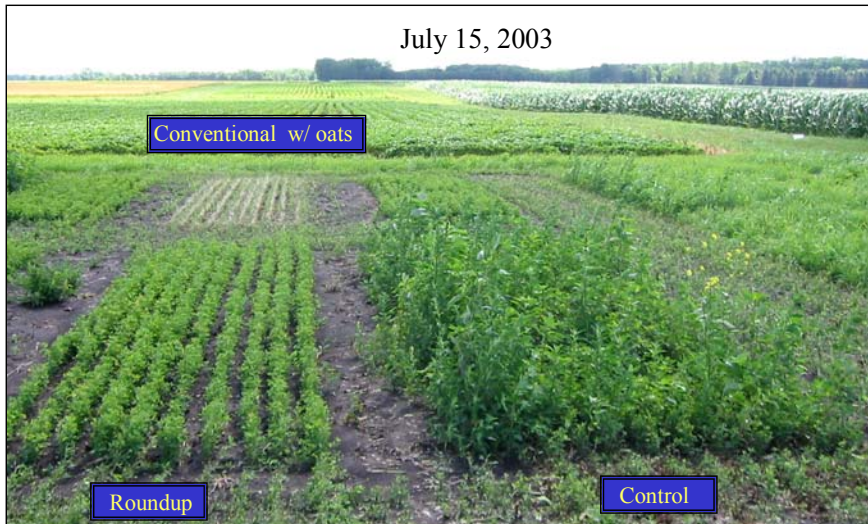


## 2003 U of MN Weed Control Study





## 2003 U of MN Weed Control Study



## 2003 Wyoming Efficacy Study



WEED CONTROL & ALFALFA RESPONSE CONTROL				WEED CONTROL & ALFALFA RESPONSE CONTROL			
RATE	BRDLF GRASS	ALFALFA		TIMING	BRDLF GRASS	ALFALFA	
P/A	(%)	T/A			(%)	T/A	
2	95	95	2.3	CO-2LF	87	88	2.4
3	97	97	2.4	2-4LF	92	92	2.3
4	97	97	2.2	4-6LF	98	96	1.9
				CO-2LF+3wk	100	100	2.3
				2-4LF+3wk	100	100	2.4





## 2003 Iowa Fall Weed Control Study



.75 AE WeatherMax- Fall

Not Treated



## Management Considerations



- Stand take-out and volunteer management
  - **Diligent Takeout.** Use appropriate commercially available herbicide treatments alone or in combination with tillage to terminate the stand.
  - **Clean Start.** If necessary, utilize tillage and / or additional herbicide application(s) after alfalfa stand termination, and before the planting of the subsequent rotation crop.
  - **Plan for Success.** Rotate to crops with known mechanical or herbicidal methods for managing volunteer alfalfa; break rotation cycle if necessary.
  - **Timely Execution.** Administer “in crop” mechanical or herbicidal treatments for managing alfalfa volunteers in a timely manner.





## Stand Take Out Trials- Nebraska



## Management Considerations



- Specific management guidance will be communicated via:
  - Monsanto Technology Use Guide
  - Monsanto Regional Technical Bulletins
  - Monsanto, FGI and seed-partner field technical and sales staff.



## Commercial Timelines



- Monsanto and Forage Genetics International commit to dairymen, livestock producers, and hay growers that all necessary regulatory submissions will be made and approvals obtained for Roundup Ready alfalfa, in the U.S. and major alfalfa export markets, before commercial planting occurs
- Regulatory approvals are only one of the key commitments we will meet prior to commercial launch. These commitments include:
  - confirm product efficacy;
  - make necessary regulatory filings and obtain approvals;
  - meet quality specifications;
  - engage growers and users, as well as the seed and feed industries and academics, to prepare for the introduction of Roundup Ready alfalfa to the alfalfa value chain.



## Commercial Timelines



- Commercialization will occur once all necessary regulatory approvals are obtained in the U.S. and major alfalfa export markets.
  - USDA submission made in Q2 2003.
  - EPA submission for proposed Roundup brand labels made in Q2 '02.
  - FDA submission made Q4 2003.
  - Ex-U.S. submissions to be made in coming year.
- Commercial launch is expected in 2005.



## Alfalfa Quality Traits in the Pipeline



- Reduced Lignin
  - Increased digestibility
  - More efficient feed conversion
- Increased Tannin content
  - Improved nitrogen utilization
  - Decrease need for protein supplements



## Next Generation of Biotech Traits



### Yield

- Photosynthesis
- Seed development
- Plant structure
- Nutrient utilization
- Harvest ability

### Quality

- Starch / Carbohydrates
- Lipids / Oils
- Protein

### Pest

- Disease resistance
- Insect resistance

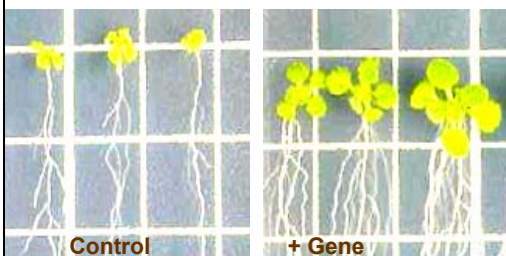
### Stress

- Heat tolerance
- Cold tolerance
- Drought tolerance
- Nutrient conversion





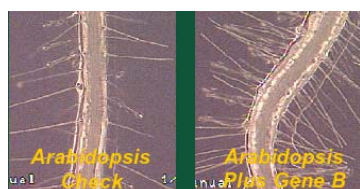
## New Genes entering the Pipeline



Control

+ Gene

**Nutrient Utilization**  
(better growth on lower fertilizer)



Arabidopsis  
Check

Arabidopsis  
Plus Gene B

### Soybean



Control

With Gene

**Stress Tolerance**

(Better performance on less water)



Control

With Gene



*Thank you for your time!!!*

Questions???

